

# The height of the forthcoming SC25 as predicted using SC24 polar regions activity

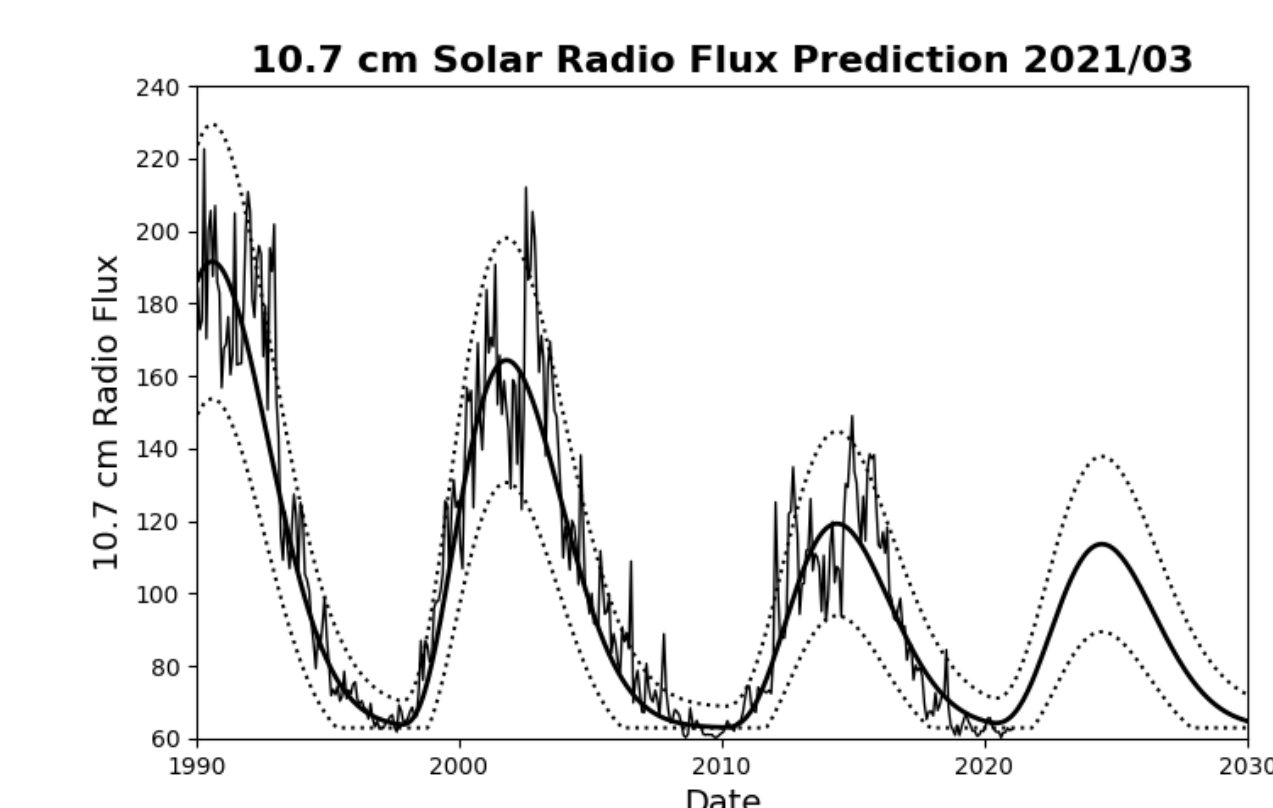
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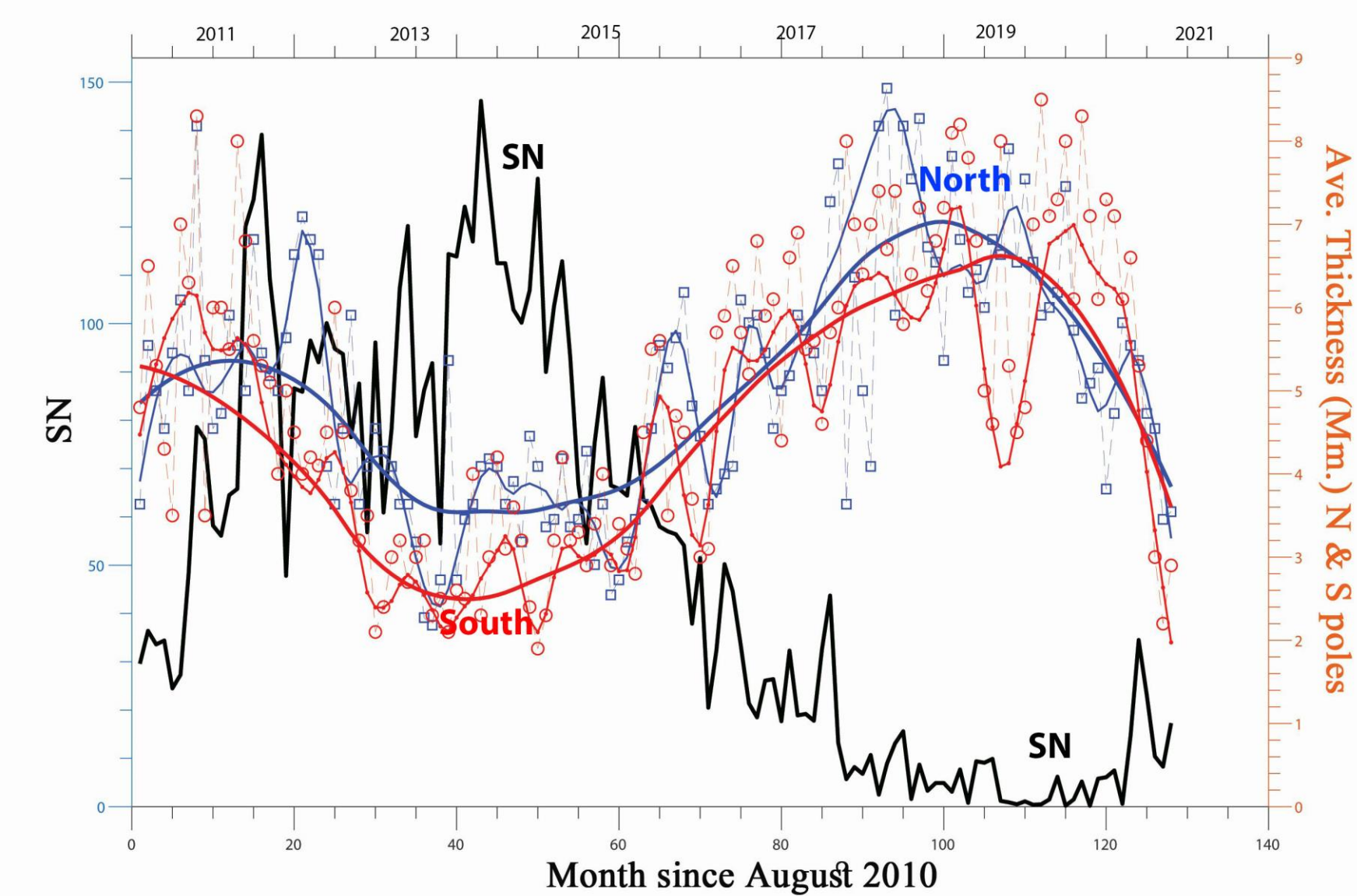


**Abstract:** The prediction of the height of the forthcoming solar activity cycle or SC (expressed by the Sunspot Number SN) is still a topic of great interest. Predictions are mainly based on statistical and/or mathematical and/or Heuristic methods, based on the analysis of past cycles "parameters"; they led to a "predicted" SC 25 similar to the preceding cycle 24, slightly lower indeed if we exclude the recent claim of the US group led by Scot McIntosh that re- interpreted the overlap of magnetic cycles. A few predictions try to use "solar activity" parameters justified by the solid belief that the solar activity is fully governed by a dynamo mechanism occurring inside the Sun. The most popular dynamo model is the so- called Babcock-Leighton (B-L) model describing the transformation and generation of a global dipolar field of the rotating Sun into a toroidal field through the differential rotation visualized near the surface. The regeneration of the next dipolar field is a critical aspect of the model, generally not well understood. In addition several puzzling features like the M- regions, the active longitudes, the occurrence of long- live big single sunspots seemingly of unipolar structure, the cyclonic and the widely "distorted" behavior of the surface magnetism with extended interacting active regions, the occurrence of Coronal Holes (CH) unpredictable by dynamo classical models, the polar regions cycles and/or recurrences and finally the large dispersion of heights of SN cycles are however the subject of hot debates. More important for practical obvious reasons is the prediction of the SCs parameters in advance. The solar activity along the SCs gives rise to geomagnetism, CMEs, flares, SEPs and associated disturbances. It has been naively suggested (following the Ohl's law) that the Polar Regions activity, with the occurrence of recurrent geo-activity in the years before and around the solar minimum of SN cycle n is rather correlated with the height of the n+1 cycle of SN. Accordingly the height of the following SN cycle could be predicted; additionally, there is now a growing consensus on the key role of polar magnetic fields as seeds for the lower latitudes SN cycles.

Height of the observed solar cycles 23 and 24 and the predicted by the NASA panel of experts height of the 25 new SN cycle (2020). Indeed a large dispersion among the different predictions exists (see the graph after showing the 10.7 cm flux variations). Our poster is now claiming a higher height of activity to come in 2024-2025, possibly reaching the 200 heights of SN. It should include the occurrence of a double maximum.



Height of the observed solar cycles SC 22, 23 and 24 and the predicted SC 25 as given by the solar radio flux at 10.7 cm. Note the large dispersion in the height of SC 25. From the site of David Hathaway at <http://solarcyclescience.com/forecasts.html>



Variations of the apparent « thicknesses » of the transition region polar regions shells as measured using the 304 emissions from AIA images of the SDO mission- NASA. Both the North (N) in blue and the South (S) in red poles are showing an extended shell (macro- spicules activity) at Years of the solar minima but during the last period around 2019, an **enhanced activity** is recorded suggesting that the next SC 25 will be high. In black line the SN during the same period of time.

We looked at the activity of Polar Regions using proxies: i/ density of polar faculae from visually evaluated their intensities and number from HMI of SDO mission W-L filtergrams; ii/ numbers of cool ejection events seen above the chromospheric limb from a 15 Years survey of the Pic du Midi CLIMSO deep H $\alpha$  observations; iii/ averaged extensions of the 304 shell of Polar Regions related to the polar CHs macro- spicules activity at time of solar low activity. Time variations of these parameters qualitatively point to a cycle 25 that could reach high levels, up to 2 times the height of the cycle 24, in contrast with the moderate height predicted by the Solar Cycle 25 Prediction Panel of NASA and NOAA (Chair: Doug Biesacker). The reason of this discrepancy is not clear. We better wait the occurrence of the double maximum of SN of SC 25 in 2025- 26 to go further with the interpretation.

Another interesting parameter seemingly related to this topic is the definite observation of the chromospheric prolateness (ovalisation) in the Years of the minimum of 2018- 2020 that was discovered in the Years 1998- 2020 (before SC 23) and that was not well measured in 2010- 11 (before SC 24).

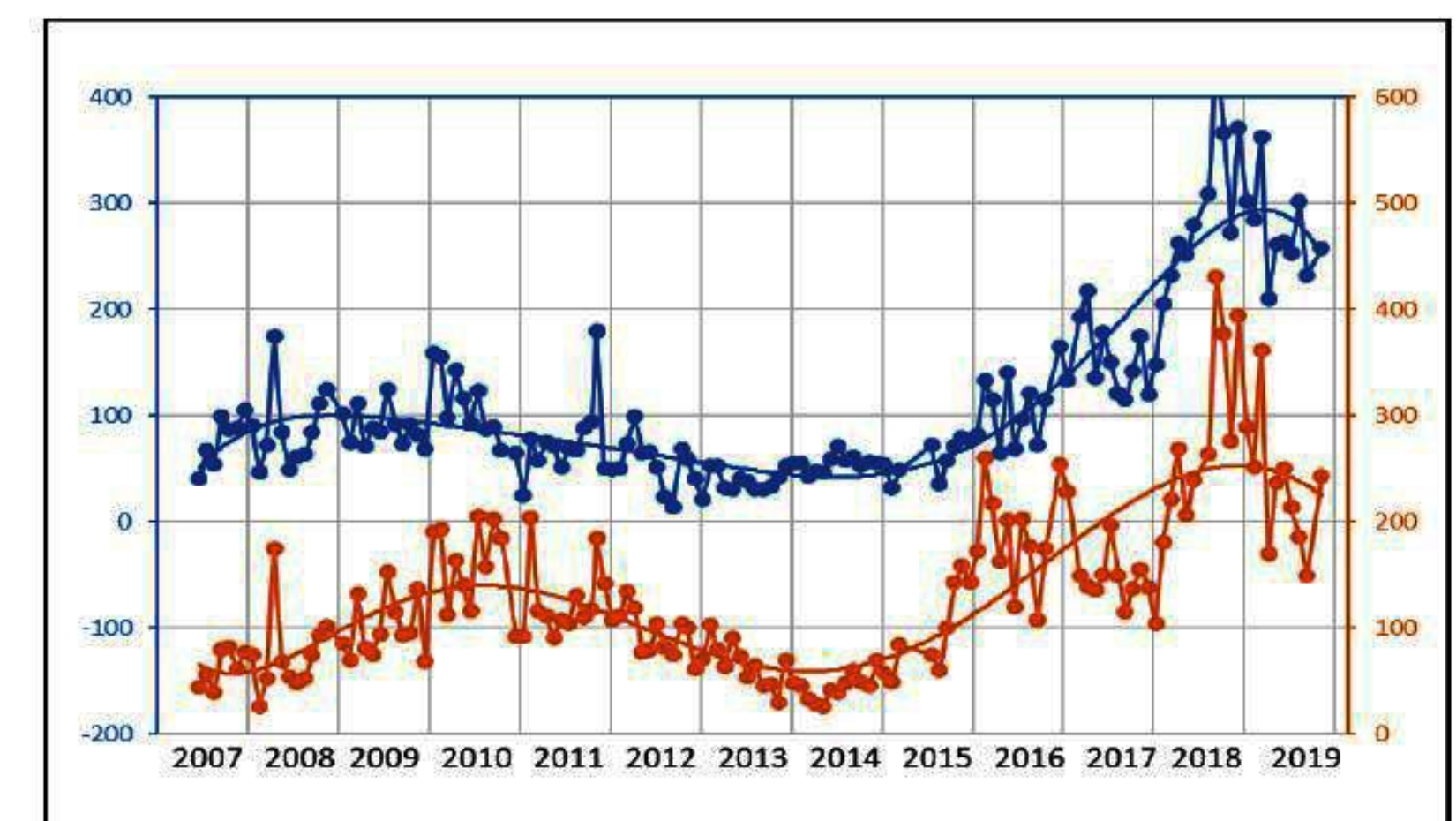
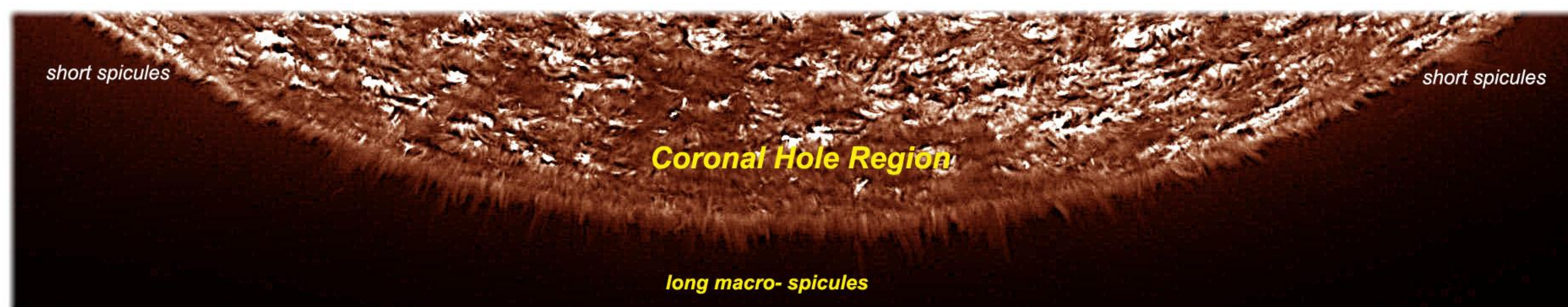


Figure 5 en bleu évolution de la fréquence des événements polaires Nord et en orange Sud. Les valeurs sont mensuelles.

Number of polar ejection-events of « cool jets » recorded above the chromospheric limb with a narrow band H $\alpha$  filter along the last SN cycles. It clearly shows a definite and large dominance of polar activity in Years 2018- 2019 suggesting the occurrence of an enhanced dipole component that would lead to a large SC 25. Data collected by the OA association of the Pic du Midi Observatory using the so- called CLIMSO set of coronagraphs sponsored by Christian Latouche.



Partial frame reconstructed image of a typical polar region at time of minimum activity to demonstrate the « abnormal » thickness of the 304 emissions (due to the HeII resonance line formed around 50 000K) in this polar region. Such extensions were measured during more than 1 solar cycle in both the South and the North regions. Extensions are believed to be due to many ejection events in nearly radial directions called macro- spicules, in contrast to spicules seen everywhere, including regions outside the coronal hole regions. AIA filtergrams of the NSO NASA mission were used after summing original frames for 10 min.

## References

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